CLAIMS

1. A method of detecting the presence of an ion comprising:

   (a) contacting a nucleic acid enzyme, the enzyme dependent on the ion to produce a product from a substrate, with a sample suspected of containing an ion; and

   (b) measuring the product of the nucleic acid enzymatic reaction.

2. The method of claim 1, wherein the nucleic acid enzyme comprises a ribozyme.

3. The method of claim 1, wherein the nucleic acid enzyme comprises a deoxyribozyme.

4. The method of claim 1, wherein the nucleic acid enzyme and the substrate comprise separate nucleic acid strands.

5. The method of claim 4, wherein the substrate comprises a fluorophore and the enzyme comprises a quencher of the fluorophore.

6. The method of claim 5, wherein a 5'-end of the substrate comprises the fluorophore.

7. The method of claim 6, wherein a 3'-end of the enzyme comprises the quencher for the fluorophore.

8. The method of claim 5, wherein the fluorophore is TAMRA.

9. The method of claim 8, wherein the quencher is DABCYL.

10. The method of claim 5, wherein the enzyme is linked to a support.

11. The method of claim 4, wherein the substrate comprises at least one ribonucleotide.

12. The method of claim 4, wherein the substrate comprises the nucleic acid sequence of SEQ ID NO:2.

13. The method of claim 4, wherein the enzyme comprises the nucleic acid sequence of SEQ ID NO:1.

14. The method of claim 3, wherein the deoxyribozyme comprises a single strand.

15. The method of claim 14, wherein the single strand comprises a fluorophore.

16. The method of claim 15, wherein the single strand further comprises a quencher for the fluorophore.

17. The method of claim 14, wherein the single strand comprises the nucleic acid sequence of SEQ ID NO:1.

18. The method of claim 17, wherein the single strand further comprises the nucleic acid sequence of SEQ ID NO: 2.

19. The method of claim 14, wherein the single strand comprises at least one ribonucleotide.

20. The method of claim 1, wherein the ion is selected from the group consisting of monovalent ions, divalent ions, trivalent ions, and polyvalent ions.

21. The method of claim 20, wherein the ion is an anion.

22. The method of claim 20, wherein the ion is a cation.

23. The method of claim 22, wherein the cation is a monovalent cation.

24. The method of claim 23, wherein the monovalent cation is selected from the group consisting of K^+, Na^+, Li^+, Tl^+, NH_4^+, and Ag^+.

25. The method of claim 22, wherein the cation is a divalent cation.

26. The method of claim 25, wherein the divalent cation is selected from the group consisting of Mg^{2+}, Ca^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Zn^{2+}, Cd^{2+}, Cu^{2+}, Pb^{2+}, Hg^{2+}, Pt^{2+}, Ra^{2+}, Ba^{2+}, and Sr^{2+}.

27. The method of claim 26, wherein the metal ion is Pb^{2+}.

28. The method of claim 22, wherein the cation is a trivalent cation.

29. The method of claim 28, wherein the trivalent cation is selected from the group consisting of Co^{3+}, Cr^{3+}, and Ln^{3+}.

30. The method of claim 22, wherein the cation is a polyvalent cation.

31. The method of claim 30, wherein the polyvalent cation is selected from the group consisting of Ce^{4+}, spermine, and spermidine.

32. The method of claim 1, wherein the product comprises a nucleic acid.

33. The method of claim 32, wherein the nucleic acid comprises a fluorophore.

34. The method of claim 32, wherein the nucleic acid comprises a fluorophore quencher.

35. The method of claim 1, wherein the sample suspected of containing the ion comprises a water sample.

36. The method of claim 1, wherein the sample suspected of containing the ion comprises a bodily fluid.

37. The method of claim 36, wherein the bodily fluid is blood.

38. The method of claim 1, wherein the measuring comprises a measurement of fluorescence.

39. The method of claim 38, wherein the measurement of fluorescence is selected from the group consisting of fluorescence intensity, fluorescence lifetime, and anisotropy.

40. The method of claim 39, wherein an increase in fluorescence is indicative of the presence of the ion.

41. The method of claim 1, wherein an array of nucleic acid enzymes comprises the nucleic acid enzyme.

42. A method of determining the concentration of an ion in a sample comprising:

(a) contacting a nucleic acid enzyme, the enzyme dependent on the ion to produce a product from a substrate, with a sample containing an unknown concentration of an ion;

(b) measuring the product of the nucleic acid enzymatic reaction; and

(c) comparing the measurement obtained in (b) with that of a standard curve created using known concentrations of the ion.

43. A biosensor comprising:

(a) a nucleic acid enzyme dependent on an ion to produce a product;

(b) a quencher; and

(c) a photodetector.

44. The biosensor of claim 43 comprising an array of nucleic acid enzymes.

45. The biosensor of claim 44, wherein the array comprises nucleic acid enzymes together having a range of ion specificities.

46. The biosensor of claim 43 further comprising a fluorophore.

47. A biosensor comprising:

(a) a nucleic acid enzyme dependent on an ion to produce a product;

(b) a fluorophore; and

(c) a photodetector.

48. A composition comprising a nucleic acid enzyme linked to a fluorophore.

49. A composition comprising a nucleic acid enzyme linked to a quencher.

50. A composition comprising a nucleic acid enzyme, substrate, fluorophore, and quencher.

51. A composition comprising a substrate for a nucleic acid enzyme linked to a quencher.

52. A composition comprising a substrate for a nucleic acid enzyme linked to a fluorophore.